

**CLAIMS**

We claim:

1. A heating element comprising:

a substrate;

a conductive layer disposed over the substrate to define a first conductive trace and a second conductive trace with a spacer therebetween; and

a resistive layer covering the first conductive trace, the second conductive trace and the spacer, wherein the resistive layer at least partially electrically connects the first and the second conductive traces.

2. A heating element according to Claim 1, wherein the resistive layer has a first surface abutting the conductive traces and the spacer, and a second surface opposite the first surface, wherein the second surface is at least substantially planar.

3. A heating element according to Claim 2, wherein each of the conductive traces has a sidewall facing the other conductive trace, the sidewall being at least substantially perpendicular to the first surface of the resistive layer.

4. A heating element according to Claim 1, wherein the spacer is made of the same material as the resistive layer.

5. A heating element according to Claim 1, wherein the spacer comprises an electrically insulating material selected from a group consisting of BPSG, PSG, TEOS, and silicon nitride.

1 6. A heating element according to Claim 1, wherein the spacer and the  
2 conductive traces have respective surfaces abutting the resistive layer, the surfaces  
3 being at least substantially coplanar with respect to each other.

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5 7. A heating element according to Claim 6, wherein the surfaces are chemical  
6 mechanically polished.

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8 8. A heating element according to Claim 1, wherein the substrate comprises an  
9 insulating layer on which the conductive layer is disposed over.

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11 9. A heating element according to Claim 8, wherein the spacer is a protruding  
12 part of the insulating layer.

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14 10. A heating element according to Claim 1, wherein the resistive layer is at least  
15 substantially uniformly thick.

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18 11. A fluid ejection device comprising:  
19 a substrate;  
20 a conductive layer disposed over the substrate to define a first  
21 conductive trace and a second conductive trace with a spacer therebetween;  
22 a resistive layer covering the first conductive trace, the second  
23 conductive trace and the spacer, wherein the resistive layer at least partially  
24 electrically connects the first and the second conductive traces; and  
25 a barrier layer adjacent the resistive layer that defines a fluid chamber  
26 in which fluid may be heated and ejected therefrom.

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28 12. A printhead comprising:  
29 a substrate;

1           a conductive layer disposed over the substrate to define a first  
2 conductive trace and a second conductive trace with a spacer therebetween;  
3           a resistive layer covering the first conductive trace, the second  
4 conductive trace and the spacer, wherein the resistive layer at least partially  
5 electrically connects the first and the second conductive traces; and  
6           a barrier layer adjacent the resistive layer that defines a firing chamber  
7 in which fluid may be heated and ejected therefrom.

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9 13. A print cartridge comprising:

10           a fluid reservoir; and  
11           a printhead fluidically coupled with the fluid reservoir, wherein the  
12 printhead comprises a substrate; a conductive layer disposed over the  
13 substrate to define a first conductive trace and a second conductive trace with  
14 a spacer therebetween; a resistive layer covering the first conductive trace, the  
15 second conductive trace and the spacer, wherein the resistive layer at least  
16 partially electrically connects the first and the second conductive traces; and a  
17 barrier layer adjacent the resistive layer that defines a firing chamber in which  
18 fluid from the reservoir may be heated and ejected therefrom.

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20 14. A method of manufacturing a heating element comprising:

21           forming a conductive layer to define a first conductive trace and a  
22 second conductive trace over a substrate, the first conductive trace being  
23 separated from the second conductive trace by a spacer; and

24           forming a resistive layer on the conductive layer to cover the first  
25 conductive trace, the second conductive trace and the spacer, wherein the  
26 resistive layer at least partially electrically connects the first conductive trace  
27 and the second conductive trace.

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29 15. A method according to Claim 14, wherein forming a conductive layer  
30 comprises:

1           forming a conductive layer on a substrate;  
2           removing a portion of the conductive layer to define the first conductive  
3 trace, the second conductive trace and a void therebetween;  
4           filling the void with an electrically insulating material; and  
5           planarizing at least a surface of the electrically insulating material such  
6 that the surface is at least substantially coplanar with corresponding surfaces  
7 of the conductive traces.

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10 16. A method according to Claim 15, wherein the electrically insulating material is  
11 selected from a group of materials consisting of BPSG, PSG, TEOS, and silicon  
12 nitride.

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14 17. A method according to Claim 15, wherein planarizing comprises chemical  
15 mechanical polishing.

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17 18. A method according to Claim 14, wherein forming a conductive layer  
18 comprises:

19           forming an insulating layer on the substrate;  
20           removing portions of the insulating layer to define a protruding portion  
21 flanked by two shoulder portions;  
22           forming a conductive layer on the insulating layer to cover the  
23 protruding portion and the shoulder portions; and  
24           planarizing a surface of the conductive layer to expose the protruding  
25 portion to thereby separate the first conductive trace from the second  
26 conductive trace.

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28 19. A method according to Claim 14, wherein the resistive layer is at least  
29 substantially uniformly thick.